

**FY04 Core Support for Shuttle Environmental Assurance (SEA)
Programs and Projects**

**Status Report #3
August 13, 2004**

**NASA Contract: NAS10-03029
Task Order No. 4**



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Executive Summary

International Trade Bridge Inc. (ITB) is supporting the Propulsion Systems Engineering and Integration (PSE&I) Office in implementing the Shuttle Environmental Assurance (SEA) Initiative. This work consists of environmental engineering, technical, business, interface, integration, management and administrative efforts required to develop, plan and integrate environmental activities for NASA's Space Shuttle Program (SSP) and for other related Agency wide environmental programs supported by the SSP PSE&I Office. This status report covers the period May 2004 through July 2004.

During this reporting period ITB completed the SEA Annual report and supported the SEA face to face held at Kennedy Space Center in May. ITB also provided briefings for the Integrated Logistics Panel, the Army Environmental Support Office Quarterly In-Process Review, and for PSE&I on materials issues. During this reporting period ITB also supported ongoing work on the SEA collaborative studies including collection of usage data and development of an initial rough draft of the reports for chromated conversion coatings and primers.

Introduction

The Propulsion Systems Engineering and Integration (PSE&I) Office at Marshall Space Flight Center (MSFC) was tasked to lead the Shuttle Environmental Assurance (SEA) Initiative established by the Space Shuttle Program (SSP) Manager in 2000. SEA is to promote environmental excellence, proactively manage materials obsolescence and optimize associated resources. SEA and the MSFC PSE&I Office also support the SSP in other Shuttle related pollution prevention and environmental issues, including range safety concerns.

SEA works to proactively identify regulatory and other drivers for materials replacement, provides a forum for data sharing and communication to management, and reduces duplication of effort among the shuttle elements through establishment of effective management tools and projects that reduce NASA's environmental risks. PSE&I is working with the NASA Acquisition Pollution Prevention (AP2) Program Office at Kennedy Space Center (KSC) in the proactive identification and integration of pollution prevention, systems safety, and health risk assessments for related NASA programs and initiatives.

International Trade Bridge Inc. (ITB) is supporting the PSE&I Office in implementing the SEA Initiative. This quarterly report summarizes ITB core support for the SEA Program and Projects. This work consists of environmental engineering, technical, business, interface, integration, management and administrative efforts required to develop, plan and integrate environmental activities for NASA's SSP and for other related Agency wide environmental programs supported by NASA's Propulsion Systems Engineering and Integration Office.

Ms. Anne Meinhold is accomplishing the ITB, Inc. support to the SEA at Marshall Space Flight Center (MSFC) through Task Order 4, which began on October 31, 2003. This is the third status report for this task order and covers the period of May 1, 2004 through July 31, 2004.

Accomplishments this Reporting Period

- Completed Final SEA 2003 Annual Report
- Tracked Program Control Review Board Directives (PRCBD) and Change Request (CR) actions addressing Columbia Accident Investigation Board (CAIB) Observations on public risk associated with Shuttle flight (S064026)
- Tracked range safety panel discussions and briefings concerning possible extension of Solid Rocket Booster (SRB) linear shaped charge
- Developed annotated outline for collaborative study reports and rough first draft of hexavalent chromium reports
- Continued work on collaborative study risk assessments and environmental, safety and health assessments of currently used products and potential alternatives
- Worked with elements and contractors to collect usage data for chromated primers, conversion coatings and cadmium plated components
- Prepared SEA briefing for Integrated Logistics Panel Meeting, June 22, 2004
- Prepared briefing and attended meeting of Army Environmental Support Office In Process Review, June 3, 2004
- Supported SEA face to face meeting, prepared and delivered presentations, May 5-7, 2004
- Prepared comments to Draft Shuttle fly-out/phase out plan

Cost Summary for this Reporting Period

75% of funding expended as of July 31, 2004

Status and Progress

Technical Evaluations

Change Requests

In preparation for return to flight, the PSE&I Office is reviewing and tracking formal CRs and PRCBDs that may affect more than one Shuttle element. ITB is supporting PSE&I in reviewing, commenting on and tracking the progress of CRs and PRCBDs that are related to SEA issues and other environmental and range safety concerns.

Range Safety Panel

ITB supports PSE&I in tracking work by the Range Safety Panel related to range safety issues. Issues of particular concern include a series of actions and PRCB briefings related to range safety issues identified as findings and observations by the CAIB report. ITB provided comments on PRCBD S064026 and will continue to actively track these CRs and PRCBDs through participation in PRCB meetings and review of documents. ITB summarized these CRs and how they address CAIB observations. ITB's major concern with the approach taken by the Range Safety Panel is that range safety issues are not being addressed in an integrated way. Estimates of risk and decisions concerning risk mitigation (such as alternate landing sites, changes in flight rules) should be made with all available information and by weighing costs and benefits.

The Range Safety Panel is also assessing the feasibility and potential risk reduction that would be achieved by extending the linear shaped charge on the SRB down to the aft segment. Most of the predicted risk associated with debris following a catastrophic accident on ascent comes from the breakup of a free flying SRB over a populated area. The linear shaped charge (LSC) used to detonate the SRB in this situation does not extend to the aft segment of the booster. The Air Force model used to assess risk associated with a catastrophic accident on launch assumes that the aft segment will impact land intact, and that the fuel remaining will detonate causing a large debris impact. Data from Challenger suggest that this is possible, and RSRM (Reusable Solid Rocket Motor) does not have data suggesting otherwise. The Range Safety Panel has estimated that extending the LSC to the aft segment would reduce the Ec (expected number of casualties/deaths) by about a factor of 7.

R&D of SSP Materials Replacement Technology and Processes

SEA Issues

The SEA team is currently working 19 issues. SEA has closed one issue, identified one new issue and facilitated mitigation of one issue by other SSP groups. Four of these issues are being addressed in collaborative studies, and ITB has major responsibility for facilitating this work.

SEA Issues

Issue	Category
HCFC 141b Blowing Agent	High baseline risk
1,1,1 Trichloroethane Elimination (Orbiter use)	High baseline risk
1,1,1 Trichloroethane Elimination (RSRM use)	High baseline risk
Cadmium Replacement in Plating Applications	Medium baseline risk
Hexavalent Chromium Replacement in Primers	Medium baseline risk
Hexavalent Chromium Replacement in Conversion Coatings	Medium baseline risk
Chemical Paint Stripper Alternatives	Medium baseline risk
Alternate Dry-Film Lubricant	Medium baseline risk
High volatile Organic Carbon Coatings	Medium baseline risk
Hypalon Paint	Medium baseline risk
Lead-Free Electronics	Medium baseline risk
Hexavalent Chromium in Alkaline Cleaners	Low baseline risk
Hazardous Air Pollutant inks	Low baseline risk
Methyl Ethyl Ketone Replacement	Low baseline risk
Cleaning and Verification Solvents	Low baseline risk
Perfluoroalkyl Sulfonates	Low baseline risk
3M Tapes	Closed
Brominated Flame Retardants	New
Neoflon™/Kel F	Track/Facilitate

ITB is tracking the JG-PP lead free solder project and plans to attend the face to face meeting scheduled for September 2004. Completed test vehicles, both manufactured and reworked were shipped to the various testing locations in July. The wiring and test set up is underway, and the testing phase is scheduled to run from August through November 2004.

New issues identified by SEA include the obsolescence of HD2 Conoco grease used by all of the Shuttle elements and a concern identified by a NASA Advisory (NA-HQ-2004-01) alert that suggests that use of aqueous cleaners on high strength steel could result in hydrogen embrittlement. During this reporting period ITB developed a formal action request to collect data from each element estimating the amount of HD2 grease that will be required through the end of the program. ATK Thiokol is planning a lifetime buy of the natural sulfonate used to manufacture the HD2 grease, and plans to acquire enough of the material to satisfy the needs of all the Shuttle elements.

SEA Issue Management

Baseline risks are assessed using the Space Shuttle Program risk matrix. Risks associated with the loss of a material are assessed in terms of both probability and impact. SEA plans to assess current risk using a modification of the stoplight approach used by the Integration Office in tracking projects required for return to flight. SEA issues will be assessed in terms of technical risk and schedule/cost risk. These risks will reflect the current program risk, and are independent of the issue's baseline (without mitigation) risk. ITB prepared and delivered a briefing for the May face to face that discusses this approach (Appendix A).

Collaborative Studies

SEA is initiating scoping studies to provide recommendations to the SSP concerning the potential benefits of future, multi-element collaborative replacement efforts for four materials: HCFC 141b in

TPS, hexavalent chromium in epoxy primers, hexavalent chromium in conversion coatings, and cadmium in plating applications. In these studies, the affected hardware elements will (1) identify common performance requirements for replacement materials; (2) summarize work done by other agencies; (3) identify potential replacements; (4) make recommendations to the Program; and (5) develop a coordinated mitigation plan.

The Conversion coating study was initiated in October 2003. The primer and cadmium studies were initiated in December 2003. Recommendations for further Program action and, if appropriate, a coordinated mitigation plan for these three collaborative efforts is planned for completion in FY04. Collaborative work on the replacement of HCFC-141b will be initiated during FY 2004 and the schedule will depend on return to flight activities.

ITB is supporting SEA in managing and facilitating these collaborative studies, and developed an annotated outline for the collaborative study reports. ITB will be responsible for the risk assessment and environmental health and safety screening of currently used and alternative materials, and initiated that effort this quarter. The ITB staff in the AP2 Office is working closely with SEA in identifying requirements for replacement materials as well as identifying and summarizing work done by other agencies. During this reporting period Patti Lewis (ITB/AP2) has provided detailed summaries of work being done by other agencies in support of these studies. ITB has also worked to collect usage data for chromated primers, chromated conversion coatings and cadmium plated components to support a risk assessment and environmental health and safety analysis (Appendix B). ITB also prepared a rough initial draft of the chromated conversion coating and chromated primer report to support Lockheed Martin in preparing a report to satisfy their Special Development Study requirement by September 2004 (Appendix C).

SEA Interface Management and Integration Support

ITB is working to develop interfaces with other NASA organizations and agencies to leverage information, aid in technology transfer, and optimize resources for the SSP and other agencies. Ms. Meinhold continued to work with the AP2 Office to share information generated by SEA and to pass on Pollution Prevention requests from the Clean Air Act Working Group and other NASA organizations. The NASA AP2 Office is providing support to the SEA in its implementation of the Collaborative Studies work and has been providing useful information and contacts to the group. ITB also continues to engage the MSFC Environmental Office and the Engineering Directorate in SEA activities and the SEA collaborative studies. ITB is also working to engage the Air Force Space Command at Peterson Air Force Base in working with SEA. Mr. Dean Dunn with Air Force Space Command is interested in collaborating with NASA and Shuttle on mitigation projects, and plans to attend SEA teleconferences and future face to face meetings.

ITB developed a briefing for the Integrated Logistics Panel meeting held June 22, 2004. ITB also prepared a SEA briefing and attended a meeting of the In Process Review hosted by Redstone Arsenal and held in Huntsville June 3, 2004.

ITB attended the 2004 NASA Environmental Conference, May 24-27 in Albuquerque, New Mexico. A major emphasis of the conference was sustainability, and several presentations focused on how NASA centers can work toward this goal. NASA Code JE announced plans to establish a NASA Center of Excellence focused on sustainability.

Administrative Support

Shuttle Fly-out/Phase-Out Plan

The SSP is beginning to plan for the eventual decommissioning of the Shuttle. This effort will require an assessment of personnel, assets and environmental issues. ITB reviewed the initial draft of the Fly-out/ Phase-out plan, and suggested more specific language outlining the efforts that will be required to identify and plan for environmental issues associated with an SSP Phase-out. These include issues associated with the disposition of facilities, hardware and materials, environmental remediation, identification of risk management options and associated cost and schedule estimates and the identification of liability issues and compliance responsibilities.

Annual Report

ITB drafted the initial review draft for the SEA 2003 Annual report. This draft was completed on January 30, 2004. ITB addressed comments by the SEA team and sent out a final review draft in March. ITB made changes to this draft and prepared photographs for inclusion in the report. This draft was completed April 30. ITB is working with MSFC graphics to prepare the layout of the document. The report was finalized in June 2004.

Manager Update

The SEA PSI team updated PSE&I Management and Engineers on materials issues identified by SEA. These included PCTFE, Hydrogen Embrittlement, HD2 grease and Brominated Flame Retardants. ITB had lead responsibility for these briefing materials.

Meetings

ITB supported the planning for the SEA face to face meeting held at the USA NSLD Building in Cape Canaveral, May 4-6. ITB supported development of meeting agendas, and coordinated the purchase of give-aways and other team building projects. ITB also developed and presented briefings on Issue Management and SEA Future Planning.

Awards

ITB was included in three Marshall Space Flight Center Group Achievement Awards this spring.

- Member of the MSFC Environmental Excellence Team
- Member of the Shuttle Environmental Assurance Team
- Member of the Shuttle Propulsion Action Center in support of the Columbia investigation

Technical Products and Deliverables

Technical reports and deliverables completed this reporting period include:

- Final 2003 Annual Report (available on SEA website)
- Briefing materials: SEA Issue Management (Appendix A)
- Collaborative Study Usage Data (Appendix B)
- Collaborative Study Report Initial Draft for Hexavalent Chromium (Appendix C)
- Integrated Logistics Panel briefing
- Army Environmental Support Office In Process Review
- PSE&I Manager /Engineer Materials Briefing